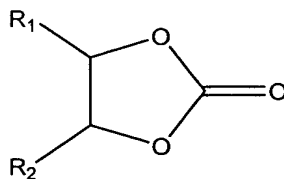


1 WHAT IS CLAIMED IS:

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3 1. A process for preparing Group II metal overbased sulfurized
4 alkylphenols which comprises:

5 forming a reaction mixture by combining a sulfurized alkylphenol wherein
6 the alkyl group contains a sufficient number of carbon atoms to render
7 oil-soluble the resulting Group II metal overbased sulfurized alkylphenol,
8 an alkanol containing about 6 to about 15 carbon atoms, a Group II
9 metal oxide, hydroxide or C₁-C₆ alkoxide, a C₂-C₁₀ alkylene glycol and
10 with an alkylene carbonate selected from ethylene carbonate or a
11 mono-alkyl or di-alkyl substituted ethylene carbonate, said alkylene
12 carbonate having the following structure:



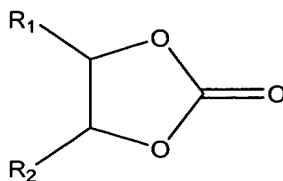
14 wherein R₁ and R₂ are independently hydrogen or alkyl containing one to
15 three carbon atoms; and wherein the contacting is carried out for a time
16 and at a temperature sufficient to form in situ carbon dioxide and
17 alkylene glycol, or a reacting equivalent, to form a product comprising a
18 Group II earth metal overbased sulfurized alkylphenol.

19 2. The process of claim 1 wherein the sulfurized alkylphenol is a Group II
20 metal sulfurized alkylphenate.

21 3. The process of claim 1 further comprising an oil-soluble Group II metal
22 overbased natural or synthetic hydrocarbyl sulfonic acid, sulfonate, or
23 mixtures thereof.

- 1 4. The process of claim 1 wherein the alkylene carbonate is added to the
2 reaction mixture over a time period of about 5 minutes to about
3 120 minutes.
- 4 5. The process of claim 4 wherein the alkylene carbonate is added to the
5 reaction mixture over a time period of about 15 minutes to about
6 90 minutes.
- 7 6. The process of claim 5 wherein the alkylene carbonate is added to the
8 reaction mixture over a time period of about 30 minutes to about
9 60 minutes.
- 10 7. The process of claim 1 wherein the temperature is maintained below
11 about 215°C.
- 12 8. The process of claim 7 wherein the temperature is maintained between
13 150°C and 210°C.
- 14 9. The process of claim 1 wherein the alkyl group of the alkylene carbonate
15 is a methyl group.
- 16 10. The process of claim 1 wherein the alkylene carbonate is ethylene
17 carbonate.
- 18 11. A process for preparing Group II metal overbased sulfurized
19 alkylphenols which comprises the steps of:
- 20 (a) forming a reaction mixture by combining a sulfurized alkylphenol
21 wherein the alkyl group contains a sufficient number of carbon
22 atoms to render oil-soluble the resulting Group II metal overbased
23 sulfurized alkylphenol, an alkanol containing about 6 to about
24 15 carbon atoms, a Group II metal oxide, hydroxide or C₁-C₆
25 alkoxide, and a C₂-C₁₀ alkylene glycol; and

1 (b) contacting said reaction mixture with an alkylene carbonate
2 selected from ethylene carbonate or a mono-alkyl or di-alkyl
3 substituted ethylene carbonate, said alkylene carbonate having the
4 following structure:



5
6 wherein R₁ and R₂ are independently hydrogen or alkyl containing
7 one to three carbon atoms; and wherein the contacting is carried
8 out for a time and at a temperature sufficient to form in situ carbon
9 dioxide and alkylene glycol, or a reacting equivalent, to form a
10 product comprising a Group II earth metal overbased sulfurized
11 alkylphenol.

12 12. The process of claim 11 wherein the sulfurized alkylphenol is a Group II
13 metal sulfurized alkylphenate.

14 13. The process of claim 11 further comprising in step (a) an oil-soluble
15 Group II metal overbased natural or synthetic hydrocarbyl sulfonic acid,
16 sulfonate, or mixtures thereof.

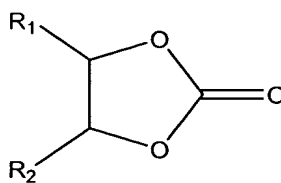
17 14. The process of claim 11 wherein in step (b) the alkylene carbonate is
18 added to the reaction mixture over a time period of about 5 minutes to
19 about 120 minutes.

20 15. The process of claim 14 wherein in step (b) the alkylene carbonate is
21 added to the reaction mixture over a time period of about 15 minutes to
22 about 90 minutes.

- 1 16. The process of claim 15 wherein in step (b) the alkylene carbonate is
2 added to the reaction mixture over a time period of about 30 minutes to
3 about 60 minutes.
- 4 17. The process of claim 11 wherein in step (b) the temperature is
5 maintained below about 215°C.
- 6 18. The process of claim 17 wherein in step (b) the temperature is
7 maintained between 150°C and 210°C.
- 8 19. The process of claim 11 wherein in step (b) the alkyl group of the
9 alkylene carbonate is a methyl group.
- 10 20. The process of claim 11 wherein in step (b) the alkylene carbonate is
11 ethylene carbonate.
- 12 21. A process for preparing Group II metal overbased sulfurized
13 alkylphenols which comprises the steps of:
- 14 (a) forming a first reaction mixture by combining an alkylphenol
15 wherein the alkyl group contains a sufficient number of carbon
16 atoms to render oil-soluble the resulting Group II metal overbased
17 sulfurized alkylphenol, an oil-soluble Group II metal overbased
18 natural or synthetic hydrocarbyl sulfonic acid, sulfonate, or mixtures
19 thereof, and an alkanol containing about 6 to about 15 carbon
20 atoms, the temperature of said first reaction mixture being at least
21 about 40°C;
- 22 (b) contacting said first reaction mixture with a second reaction mixture
23 comprising a Group II metal oxide, hydroxide or C₁-C₆ alkoxide; a
24 sulfurization agent and an inert hydrocarbon diluent at a
25 temperature and for a time sufficient to effect sulfurization of the
26 alkylphenol to form a third reaction mixture;

1 (c) contacting said third reaction mixture with C₂-C₁₀ alkylene glycol to
2 form a fourth reaction mixture; and

3 (d) contacting said fourth reaction mixture with an alkylene carbonate
4 selected from ethylene carbonate or a mono-alkyl or di-alkyl
5 substituted ethylene carbonate, said alkylene carbonate having the
6 following structure:



8 wherein R₁ and R₂ are independently hydrogen or alkyl containing
9 one to three carbon atoms; and wherein said contacting is carried
10 out for a time and at a temperature sufficient to form in situ carbon
11 dioxide and alkylene glycol, or a reacting equivalent, to form a
12 product comprising a Group II earth metal overbased sulfurized
13 alkylphenol.

14 22. The process of claim 21 wherein in step (d) the alkylene carbonate is
15 added to the fourth reaction mixture over a time period of about
16 5 minutes to about 120 minutes.

17 23. The process of claim 22 wherein in step (d) the alkylene carbonate is
18 added to the fourth reaction mixture over a time period of about
19 15 minutes to about 90 minutes.

20 24. The process of claim 23 wherein in step (d) the alkylene carbonate is
21 added to the fourth reaction mixture over a time period of about
22 30 minutes to about 60 minutes.

- 1 25. The process of claim 21 wherein in step (d) the temperature is
2 maintained below about 215°C.
- 3 26. The process of claim 25 wherein in step (d) the temperature is
4 maintained between 150°C and 210°C.
- 5 27. The process of claim 21 wherein in step (d) the alkyl group of the
6 alkylene carbonate is a methyl group.
- 7 28. The process of claim 21 wherein in step (d) the alkylene carbonate is
8 ethylene carbonate.
- 9 29. The process of claim 21 wherein the ratio of the alkylene carbonate to
10 the alkylphenol is 0.6 to 1.5 weight percent.
- 11 30. The process of claim 21 wherein the charge mole ratio of the sulfur to
12 the alkylphenol added in step (b) is about 1.0 to about 1.7.
- 13 31. The process of claim 30 wherein the charge mole ratio of the sulfur to
14 the alkylphenol added in step (b) is about 1.3 to about 1.5.
- 15 32. The process of claim 21 wherein in step (c), after contacting the third
16 reaction mixture with a C₂-C₁₀ alkylene glycol, the temperature of the
17 system is raised, if necessary, from that of step (b) to between about
18 120°C and about 190°C.
- 19 33. The process of claim 21 wherein in step (c) the C₂-C₁₀ alkylene glycol
20 addition is conducted at from about 100°C to about 190°C.
- 21 34. The process of claim 33 wherein in step (c) the C₂-C₁₀ alkylene glycol
22 addition is conducted at from 125°C to 165°C.
- 23 35. The process of claim 21 further comprising:

- 1 (e) heating the fourth reaction mixture of step (d) under reduced
2 pressure to remove a portion of unreacted C₂-C₁₀ alkylene glycol
3 and carbon dioxide.
- 4 36. The process of claim 35 wherein step (e) is preferably conducted at from
5 about 175°C to about 210°C.
- 6 37. The process of claim 21 further comprising in step (a) or in step (b), or in
7 both steps (a) and (b), the presence of a sulfurization catalyst, wherein
8 the sulfurization catalyst is a hydrogen halide, an ammonium halide, a
9 metal halide or 2-mercaptobenzothiozole.
- 10 38. The process of claim 37 wherein the sulfurization catalyst is a metal
11 halide.
- 12 39. The process of claim 38 wherein the sulfurization catalyst is calcium
13 chloride.
- 14 40. The process of claim 21 wherein the alkyl group of the alkylphenol
15 contains from about 25 to about 100 mole percent predominantly
16 straight-chain alkyl groups containing from about 15 to about 35 carbon
17 atoms and from about 75 to about 0 mole percent branched-chain alkyl
18 groups containing from about 9 to about 18 carbon atoms.
- 19 41. The process of claim 40 wherein the alkyl group of the alkylphenol
20 contains from about 35 to about 100 mole percent predominantly
21 straight-chain alkyl groups containing from about 15 to about 35 carbon
22 atoms and from about 65 to about 0 mole percent branched-chain alkyl
23 groups containing from about 9 to about 18 carbon atoms.
- 24 42. The process of claim 41 wherein the alkyl group of the alkylphenol
25 contains from about 40 to about 70 mole percent predominantly
26 straight-chain alkyl groups containing from about 15 to about 35 carbon

- 1 atoms and from about 60 to about 30 mole percent branched-chain alkyl
2 groups containing from about 9 to about 18 carbon atoms.
- 3 43. The process of claim 42 wherein the alkyl group of the alkylphenol
4 contains approximately 50 mole percent predominantly straight-chain
5 alkyl groups containing from about 15 to about 35 carbon atoms and
6 approximately 50 mole percent branched-chain alkyl groups containing
7 from about 9 to about 18 carbon atoms.
- 8 44. The process of claim 21 wherein the alkyl group of the alkylphenol is
9 attached predominantly at the para position of the phenol ring.
- 10 45. The process of claim 44 wherein the alkylphenol containing the para
11 attachment of the alkyl group is from about 70 to about 95 weight
12 percent of the total alkylphenol.
- 13 46. The process of claim 45 wherein the alkylphenol containing the para
14 attachment of the alkyl group is from about 80 to about 95 weight
15 percent of the total alkylphenol.
- 16 47. The process of claim 21 wherein the alkanol contains about 8 to about
17 13 carbon atoms and the C₂-C₁₀ alkylene glycol is ethylene glycol.
- 18 48. The process of claim 47 wherein the alkanol is isodecyl alcohol.
- 19 49. The process of claim 21 wherein the hydrocarbyl group of the oil-soluble
20 Group II metal overbased natural or synthetic hydrocarbyl sulfonic acid,
21 sulfonate, or mixtures thereof, is an alkyl aromatic group.
- 22 50. The process of claim 49 wherein the alkyl group of the alkyl aromatic
23 group contains from about 6 carbon atoms to about 60 carbon atoms.

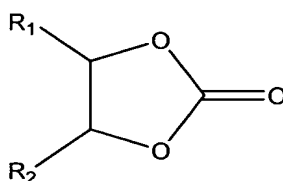
- 1 51. The process of claim 50 wherein the alkyl group of the alkyl aromatic
2 group contains from about 10 carbon atoms to about 40 carbon atoms.
- 3 52. The process of claim 51 wherein the alkyl group of the alkyl aromatic
4 group contains from about 20 carbon atoms to about 28 carbon atoms.
- 5 53. The process of claim 21 wherein the Group II metal oxide, hydroxide or
6 C₁-C₆ alkoxide is selected from the group consisting of calcium, barium,
7 and magnesium oxide, hydroxide or C₁-C₆ alkoxide and mixtures
8 thereof.
- 9 54. The process of claim 53 wherein the Group II metal oxide, hydroxide or
10 C₁-C₆ alkoxide is calcium hydroxide.
- 11 55. The process of claim 54 wherein the Group II metal oxide, hydroxide or
12 C₁-C₆ alkoxide is Dolomite comprising Ca(OH)₂.Mg(OH)₂.
- 13 56. A product made by the process of claim 1.
- 14 57. A product made by the process of claim 11.
- 15 58. A product made by the process of claim 21.
- 16 59. A product made by the process of claim 35.
- 17 60. A product made by the process of claim 37.
- 18 61. A detergent-dispersant additive comprising Group II metal overbased
19 sulfurized alkylphenols, said additive being characterized by the
20 following properties:
- 21 (a) a color of 3.5 or lower, as measured using ASTM Test No. D 6045;
22 and

1 (b) an increased hydrolytic stability as measured by a modified ASTM
2 Test No. 2619 wherein the TBN of the Group II metal overbased
3 sulfurized alkylphenols decreases less than 10 percent after
4 dilution of the material in finished marine oil to a TBN of 10 and the
5 addition of 2.0 percent water and after 6 days at 80°C.

6 62. The detergent-dispersant additive of claim 61 wherein the TBN of the
7 Group II metal overbased sulfurized alkylphenols decreases less than
8 8 percent after dilution of the material in finished marine oil to a TBN of 8
9 and the addition of 2.0 percent water and after 6 days at 80°C.

10 63. A process for the in situ delivery of equimolar quantities of alkylene
11 glycol and carbon dioxide to a reaction mixture, wherein said reaction
12 mixture requires the presence of said alkylene glycol and said carbon
13 dioxide as reactants, said process comprising delivering to said reaction
14 mixture:

15 an alkylene carbonate selected from ethylene carbonate or a mono-alkyl
16 or di-alkyl substituted ethylene carbonate having the following structure:



18 wherein R₁ and R₂ are independently hydrogen or alkyl containing one to
19 three carbon atoms; in the presence of water; and under reaction
20 conditions sufficient to hydrolyze the alkylene carbonate to alkylene
21 glycol and carbon dioxide.

22 64. The process of claim 63 wherein the hydrolysis of the alkylene
23 carbonate to alkylene glycol and carbon dioxide is carried out at
24 temperatures in the range of about 150°C to about 215°C.

- 1 65. The process of claim 63 wherein the alkyl group of the said alkylene
2 carbonate is a methyl group.
- 3 66. The process of claim 63 wherein the said alkylene carbonate is ethylene
4 carbonate.